NAVY
SBIR FY05.3 PROPOSAL SUBMISSION INSTRUCTIONS

The responsibility for the implementation, administration and management of the Navy SBIR program is with the Office of Naval Research (ONR). The Director of the SBIR Program is Mr. John Williams, williajr@onr.navy.mil. For general inquiries or problems with electronic submission, contact the DoD Help Desk at 1-866-724-7457 (8AM to 5PM EST). For program and administrative questions, please contact the Program Managers listed in Table 1; **do not** contact them for technical questions. For technical questions about the topic, contact the Topic Authors listed under each topic on the website before **14 September 2005.** Beginning 14 September, you must use the SITIS system (http://www.dodsbir.net/Sitis/Default.asp) listed in section 1.5c of the program solicitation to receive answers to technical questions.

TABLE 1: NAVY ACTIVITY SBIR PROGRAM MANAGERS POINTS OF CONTACT

Topic Numbers	Point of Contact	Activity	Email
N05-138 thru N05-146	Mrs. Carol Van Wyk	NAVAIR	carol.vanwyk@navy.mil
N05-147 thru N05-162	Ms. Janet Jaensch	NAVSEA	JaenschJL@navsea.navy.mil
N05-163	Dr. Peter Majumdar	ONR	majumdp@onr.navy.mil
N05-164	Mr. Joe Gaines	NAVSUP	joe.gaines@navy.mil

The Navy's SBIR program is a mission-oriented program that integrates the needs and requirements of the Navy's Fleet through R&D topics that have dual-use potential, but primarily address the needs of the Navy. Companies are encouraged to submit proposals in topic areas that address the manufacturing needs of the Defense Sector. Information on the Navy SBIR Program can be found on the Navy SBIR website at **http://www.onr.navy.mil/sbir**. Additional information pertaining to the Department of the Navy's mission can be obtained by viewing the website at **http://www.navy.mil**.

PHASE I PROPOSAL SUBMISSION

Read the DoD Program Solicitation at www.dodsbir.net/solicitation for detailed instructions on proposal format and program requirements. When you prepare your proposal, keep in mind that Phase I should address the feasibility of a solution to the topic. The Phase I option should address the transition into the Phase II effort. Phase I options are typically only funded after the decision to fund the Phase II has been made. Phase I proposals, including the option, have a 25-page limit (see section 3.4). The Navy will evaluate and select Phase I proposals using review criteria based upon technical merit and other criteria as discussed in section 4.0 of the program solicitation. Due to limited funding, the Navy reserves the right to limit awards under any topic and only proposals considered to be of superior quality will be funded. The Navy typically provides a firm fixed price contract or awards a small purchase agreement as a Phase I award

For NAVAIR topics N05-138 thru N05-146 the base amount should not exceed $80,000 and 6 months with an option not exceeding $70,000 and 6 months. For topics N05-147 thru N05-164 the base effort should not exceed $70,000 and 6 months with an option not exceeding $30,000 and 3 months. **PROPOSALS THAT HAVE A HIGHER DOLLAR AMOUNT THAN ALLOWED FOR THAT TOPIC WILL BE CONSIDERED NON-RESPONSIVE**.

All proposal submissions to the Navy SBIR Program must follow the DoD guidelines for electronic submission. It is mandatory that the **entire** technical proposal, DoD Proposal Cover Sheet, Cost Proposal, and the Company Commercialization Report be submitted electronically through the DoD SBIR Submission website at **http://www.dodsbir.net/submission**.before **6:00 a.m. EST, 14 October 2005**. A hardcopy will NOT be required. A signature by hand or electronically is not required at the time of submission. If you have any questions or problems with the electronic submission contact the DoD SBIR Helpdesk at 1-866-724-7457 (8AM to 5PM EST).

Within one week of the solicitation closing, you will receive notification via e-mail that your proposal has been received and processed for evaluation by the Navy. Please make sure that your e-mail address is entered correctly on your proposal coversheet or you will not receive a notification.

PHASE I SUMMARY REPORT

All Phase I award winners must electronically submit a Phase I summary report through the Navy SBIR website at the end of their Phase I contract. The Phase I Summary Report is a non-proprietary summary of Phase I results. It should not exceed 700 words, should include potential applications and benefits, and should require minimal work from the contractor because most of this information is required in the final report. The summary of the final report will be submitted through the Navy SBIR/STTR website at: **http://www.onr.navy.mil/sbir**, click on "Submission", and then click on "Submit a Phase I or II Summary Report". This report will be made publicly accessible via the Navy's Search Database.

ADDITIONAL NOTES

The Small Business Administration (SBA) has made a determination that will permit the Naval Academy, the Naval Post Graduate School and the other military academies to participate as subcontractors in the SBIR/STTR program, since they are institutions of higher learning.

If you are submitting a proposal under a Marine Corps topic, please budget for a trip to Quantico, VA for a program review during the last month of the Phase I award.

NAVY FAST TRACK DATES AND REQUIREMENTS

The Fast Track application must be received by the Navy 150 days from the Phase I award start date. Your Phase II Proposal must be submitted within 180 days of the Phase I award start date. Any Fast Track applications or proposals not meeting these dates may be declined. All Fast Track applications and required information must be sent to the designated Contracting Officer's Technical Monitor (the Technical Point of Contact (TPOC)) for the contract and emailed to the appropriate Navy Activity SBIR Program Manager listed in Table 1 above. The information required by the Navy, is the same as the information required under the DoD Fast Track described in section 4.5 of this solicitation.

PHASE II PROPOSAL SUBMISSION

Phase II is the demonstration of the technology that was found feasible in Phase I. Only those Phase I awardees who achieved success in Phase I, measuring the results achieved against the criteria contained in section 4.3, will be invited to submit a Phase II proposal by the Navy Activity SBIR Program Manager listed in Table 1. During or at the end of the Phase I effort, awardees will be notified to participate for evaluation of their proposal for a Phase II award. If you have been invited to submit a Phase II proposal to the Navy, obtain a copy of the Phase II instructions from the Navy SBIR website. The Navy will also offer a "Fast Track" into Phase II to those companies that successfully obtain third party cash partnership funds ("Fast Track" is described in Section 4.5 of the program solicitation). The Navy typically provides a cost plus fixed fee contract or an Other Transition Agreement (OTA) as a Phase II award. The type of award is at the discretion of the contracting officer.

Each of the Navy Activities have different award amounts and schedules; you are required to visit the website cited in the invitation letter to get specific guidance for that Navy Activity before submitting your Phase II proposal. The Phase II proposal should include 2 to 5 pages of Transition/Marketing planning describing how, to whom and at what stage you will market and transition your technology to the government, government prime contractor, and/or private sector.

Phase II proposals together with the Phase II Option (if required) are limited to 40 pages (unless otherwise directed by the TPOC or contracting officer). All Phase II proposals must be submitted electronically via the DoD proposal submission site at **http://www.dodsbir.net/submission**. Complete electronic submission includes the submission of the Cover Sheets, Cost Proposal, Company Commercialization Report, and the **ENTIRE** technical proposal (including any appendices) via this site. Your proposal must be submitted via the submission site on or before the Navy Activity specified deadline.

All Phase II award winners are required to attend a one-day Transition Assistance Program (TAP) meeting typically held in the July to August time frame in the Washington D.C. area during the second year of the Phase II effort. If you receive a Phase II award, you will be contacted with more information regarding this program or you can visit http://www.dawnbreaker.com/navytap. It is recommended to budget at least one trip to Washington in your Phase II cost proposal.

As with the Phase I award, Phase II award winners must electronically submit a Phase II summary report through the Navy SBIR website at the end of their Phase II. The Phase II Summary Report is a non-proprietary summary of Phase II results. It should not exceed 700 words and should include potential applications and benefits. It should require minimal work from the contractor because most of this information is required in the final report.

A Navy Activity will not issue a Navy SBIR Phase II award to a company when the elapsed time between the completion of the Phase I award and the actual Phase II award date is eight (8) months or greater; unless the process and the award has been formally reviewed and approved by the Navy SBIR Program Office. Also, any SBIR Phase I contract that has been extended by a no cost extension beyond one (1) year will be <u>ineligible</u> for a Navy SBIR Phase II award using SBIR funds.

PHASE II ENHANCEMENT

Since the Law (PL102-564) permits Phase III awards during Phase II work, the Navy may provide a one-to-four match, subject to availability, usually up to $250,000 of SBIR Phase II enhancement funds to Phase III funds, that the company obtains from a Navy Acquisition program office. The Phase III contract must be awarded before the Phase II enhancement funds are provided by modifying the existing Phase II contract.

PHASE III

Public Law 106-554 provided for protection of SBIR data rights under SBIR Phase III awards. A Phase III SBIR award is any contract or grant where the technology is the same as, derived from, or evolved from a Phase I or a Phase II SBIR/STTR contract and awarded to the company which was awarded the Phase I/II SBIR. This covers any contract/grant issued as a follow-on Phase III SBIR award or any contract/grant award issued as a result of a competitive process where the awardee was an SBIR firm that developed the technology as a result of a Phase I or Phase II SBIR. The Navy **will** give SBIR Phase III status to any award that falls within the above-mentioned description. The government's prime contractors and/or their subcontractors shall follow the same guidelines as above and ensure that companies operating on behalf of the Navy protect data rights of the SBIR company.

PHASE I PROPOSAL SUBMISSION CHECKLIST:

All of the following criteria <u>must be met</u> or your proposal will be REJECTED.

____1. Make sure you have added a header with company name, proposal number and topic number to each page of your technical proposal.

____2. Your technical proposal has been uploaded and the DoD Proposal Cover Sheet, the DoD Company Commercialization Report, and the Cost Proposal have been submitted electronically through the DoD submission site by 6:00 a.m. EST 14 October 2005.

____3. After uploading your file and it is saved on the DoD submission site, review it to ensure that it appears correctly.

____4. For NAVAIR topics N05-138 thru N05-146, the base effort does not exceed $80,000 and 6 months and the option does not exceed $70,000 and 6 months. For topics N05-147 thru N05-164, the Phase I proposed cost for the base effort does not exceed $70,000 and 6 months and for the option $30,000 and 3 months. The costs for the base and option are clearly separate, and identified on the Proposal Cover Sheet, in the cost proposal, and in the work plan section of the proposal.

Navy SBIR 05.3 Topic Index

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N05-138 TITLE: Expendable Electro-Optic Infrared Camera System

TECHNOLOGY AREAS: Sensors

OBJECTIVE: Develop small, low cost, expendable, electro-optic/infrared (EO/IR) Camera Systems to support Unmanned Air Vehicles (UAV) launched and controlled from P-3 aircraft in direct support of their mission. Both fixed and Pan-Tilt-Zoom (PTZ) EO/IR systems are sought.

DESCRIPTION: The Navy and other government-sponsored agencies, use the P-3 aircraft in support of many diverse missions and due to the limited number of P-3 aircraft, the most economical and expeditious way to enhance operations and ensure crew safety would be to incorporate low-cost expendable Sonochute Launched UAVs (SL-UAVs). If UAVs were incorporated into each P-3, a load-out of SL-UAVs with interchangeable payloads tailored to the specific mission, could be locally launched, controlled by the on-board sensor operator, and assist the platform in successfully carrying out its mission. There are currently two (2) versions of the SL-UAV: The Coyote and the Voyeur. The Coyote requires a Pan-Tilt-Zoom (PTZ) camera system that can be no larger than 3” x 3” and must weigh under 4 pounds. The Voyeur requires a fixed EO/IR camera system that cannot exceed 2” in diameter and 3” in length, and must remain under 1.5 pounds. While there are currently commercially-off-the-shelf (COTS) Fixed EO/IR camera systems in use today that are small enough to fit into the SL-UAV, they are expensive and therefore not considered expendable. The goal would be to have the fixed EO/IR camera cost no more than $1,500.00 each when purchased in quantities of 100, thus allowing it to be expendable. There is currently no PTZ system small enough to fit on either version of the SL-UAV. Current systems can cost approximately $15,000.00 and would not fit into the available payload space of the SL-UAV. The PTZ system must be gyro-stabilized and miniaturized for less than $7,500.00 each when purchased in quantities of 100.The SL-UAV EO/IR sensor/payload should provide the sensor field of view height and width (in degrees) with a maximum error of 5 degrees and provide at a minimum half-motion (15 frames/ second) video to minimize bandwidth required. Resolution should exceed the standard RS-170 video.

PHASE I: Develop the design approach and demonstrate feasibility to meet the above requirements for an expendable EO/IR Fixed or PTZ Camera System.

PHASE II: Develop and produce a prototype expendable EO/IR Fixed or PTZ Camera System capable of launch from Navy P-3 aircraft using the current SL-UAV models.

PHASE III: Produce qualified expendable EO/IR Fixed or PTZ Camera System assets for use by SL-UAV.

PRIVATE SECTOR COMMERCIAL POTENTIAL/DUAL-USE APPLICATIONS: This technology would greatly serve other government sectors for homeland defense purposes. It could be used by search-and-rescue organizations to enable wider search areas than can be accomplished by current airborne assets as well as by commercial fishing fleets. In addition, these could potentially be used by fire-fighting organizations to drop into large-scale fires to map the location of hot spots and the forward edge of the fire while reducing risk to human life.

REFERENCES: 1. Draft Sonochute Launched – Unmanned Aerial Vehicle (SL-UAV) Performance Based Specification (PBS), 17 November 2004

KEYWORDS: EO/IR; PTZ; Camera; Unmanned Aerial Vehicles; Sonobuoy; Surveillance; Maritime

N05-139 TITLE: Data Distribution Service in Linux Kernel Module

TECHNOLOGY AREAS: Information Systems

The technology within this topic is restricted under the International Traffic in Arms Regulation (ITAR), which controls the export and import of defense-related material and services. Offerors must disclose any proposed use of foreign nationals, their country of origin, and what tasks each would accomplish in the statement of work in accordance with section 3.5.b.(7) of the solicitation.

OBJECTIVE: Develop a Linux Kernel Module that provides Data Distribution Services in the Publish Subscribe paradigm, consistent with the Object Management Group (OMG) specification for Data Distribution Service in an effort to resolve the latency issues created during system level function calls.

DESCRIPTION: The OMG adopted the Common Object Request Broker Architecture (CORBA) as a standard means to promote distributed computing. The military and other industries tried to use CORBA in real time situations and discovered that it really did not support distributed computing in a real time environment. Over the years, data centric publish subscribe tools were developed to foster distributed computing in a real time environment. The recent Data Distribution Service specification represents documentation of a standard for those types of products, see Reference 1) for URL and for additional information and download.

When application software executes, it is normally in the user mode. When the source code calls a function, which is an operating system call, the computer undergoes a context change to execute that function. When the context changes as the computer switches back and for the between kernel mode and user mode, a latency penalty is incurred. When the application calls a series of system level function calls, the computer spends time going back and forth with the context changes, and incurs latency which can adversely impact real time performance.

Linux is an open source operating system, modeled on Unix, and following along with POSIX, to include some extension into real time POSIX with Linux 2.6.n. Linux Kernel Modules run in the kernel space, like device drivers, rather than running in the user space of the computer. Data Distribution Services provide multi-cast inter-process communication, in a manner that is oblivious to the location of the other processes which are being communicated with, much like client server inter-process communication can be used either for remote communication with processes on another platform, or for local communication with processes on the same platform.

Since the Data Distribution Service is a middleware, the possibility exists that it may make some system level function calls in rapid succession, incurring the latency penalties described above. By running the service in the kernel level, it becomes possible to avoid the latency penalties of the context switches. As an open source operating system, Linux provides a vehicle for the kernel level Data Distribution Service.

PHASE I: Evaluate the technical feasibility of developing a Linux Kernel module in the near term. Define and determine the capabilities of the module, required testing, and the required maintenance to keep the module functioning with evolving technology.

PHASE II: Based on Phase I knowledge, develop, demonstrate and validate an executing prototype for one Linux kernel, 2.6.n. Test for latency in representative applications, modify kernel module, if feasible, for the 2.4.n family of Linux kernels. Demonstrate prototype module to include an application programming interface and associated development artifacts, such as UML or Data Flow diagrams.

PHASE III: Incorporate the Linux kernel modules as the mission computer expands to multiple processor cards, and expand the use of the module, as other mission computers, which currently have multiple processors, migrate to Linux.

PRIVATE SECTOR COMMERCIAL POTENTIAL/DUAL-USE APPLICATIONS: Similar capabilities are available in proprietary real time operating systems and contribute to their continuing popularity. This is likely to be a technology widely embraced by real time, embedded, and industrial software developers, and, in turn, generate opportunities to sell training, manuals, etc. on the subject kernel API (?), at a minimum. Depending on how well the module is isolated from other GNU software, the vendor may be able to commercially license their extension in much the same way that Red Hat licenses its Linux products.

REFERENCES:
1. "Data Distribution Service for Real-Time Systems Specification" : http://www.omg.org/cgi-bin/doc?ptc/2003-07-07.
2. "The Linux Kernel Module Programming Guide": http://www.tldp.org/LDP/lkmpg/
3. "Linux Loadable Kernel Module HOWTO": http://gnu.kookel.org/LDP/HOWTO/Module-HOWTO/

4. “Linux Device Drivers”: http://www.xml.com/ldd/chapter/book/

KEYWORDS: Linux Kernel Module; Data Distribution Service; Publish Subscribe; Distributed Computing; Device Driver; Operating System

N05-140 TITLE: Expendable Ad Hoc Networked Data Link System

TECHNOLOGY AREAS: Air Platform, Electronics

OBJECTIVE: Develop a small, low cost, Ad Hoc Networked Data Link System to support Unmanned Air Vehicles (UAV’s) launched and controlled from P-3 aircraft in direct support of their mission.

DESCRIPTION: The Navy and other government-sponsored agencies use the P-3 aircraft in support of many diverse missions. Given the limited number of P-3 aircraft, the most economical and expeditious way to enhance operations and ensure crew safety would be to incorporate low-cost expendable Sonochute Launched UAVs (SL-UAVs). If UAVs were incorporated into each P-3, a load-out of SL-UAV’s with interchangeable payloads tailored to the specific mission could be locally launched, controlled by the on-board sensor operator, and assist the platform in successfully carrying out its mission. NAVAIR has been developing two versions of the SL-UAV. While there are currently commercial-off-the-shelf (COTS) Ad Hoc Networked Data Link Systems in use today, they are expensive, too large, have limited range, operate only in commercial frequencies and do not have encryption. The SL-UAV Data Link shall have ad hoc network capability, IPV6 interface, and provide selectable discreet data link/communications channels for simultaneous transmission/receipt of sensor data and control of multiple SL-UAVs. The SL-UAV data link system shall provide bi-directional data link and control at ranges/distances of 20 nautical miles between the SL-UAV and the control aircraft (50 nautical miles is the objective). Directional antenna’s are not desired due to the complication of aiming/installing them on an aircraft and the limitation of only being able to control one vehicle at a time. Cost of the system on the SL-UAV shall be less than $3,500.00 and it shall weigh less than 2 pounds.

PHASE I: Develop design approach and demonstrate feasibility to meet the above requirements for an expendable Ad Hoc Networked Data Link System.

PHASE II: Develop and produce a prototype expendable Ad Hoc Networked Data Link System capable of launch from Navy P-3 aircraft using the current SL-UAV.

PHASE III: Produce qualified expendable Ad Hoc Networked Data Link System assets for use by SL-UAV.

PRIVATE SECTOR COMMERCIAL POTENTIAL/DUAL-USE APPLICATIONS: This technology could be used by other government sectors for homeland defense purposes. It could be used by search-and-rescue organizations to enable wider area search than can be accomplished by current airborne assets as well as by commercial fishing fleets. In addition, these could potentially be used by fire-fighting organizations to drop into large-scale fires to map the location of hot spots and the forward edge of the fire.

REFERENCES: 1. Draft Sonochute Launched – Unmanned Aerial Vehicle (SL-UAV) Performance Based Specification (PBS), 17 November 2004

KEYWORDS: Data Link; Ad Hoc Networked; Unmanned Aerial Vehicles; Maritime; Sonobuoy; Surveillance

N05-141 TITLE: High Density Solid State Memory for Avionic Network Applications

TECHNOLOGY AREAS: Information Systems, Sensors

ACQUISITION PROGRAM: F/A-18E/F

The technology within this topic is restricted under the International Traffic in Arms Regulation (ITAR), which controls the export and import of defense-related material and services. Offerors must disclose any proposed use of foreign nationals, their country of origin, and what tasks each would accomplish in the statement of work in accordance with section 3.5.b.(7) of the solicitation.

OBJECTIVE: Develop innovative technologies that leverage on the latest advancement in COTS based memory technologies to provide vast improvements in solid-state memory density and packaging to meet the new demands of Network Centric Warfare capabilities.

DESCRIPTION: Many of tomorrows platforms will need to increase their infrastructure to accommodate emerging Network Centric Warfare capabilities. Memory density and its associated packaging costs will be a limiting factor in supporting the various mission capability packages that tomorrow's aircraft will be asked to perform. The limitations of bandwidth will drive resulting on-board storage processing capabilities. The final form factor for these memory cards must be compatible with legacy avionics systems such as VME 3U or smaller daughter cards. The end item will be a ruggedized bulk data cartridge with a PCI interface, capable of being removed and replaced.

Analyze, benchmark commercial advancements and define interface requirements in support of a initial design for a solid-state memory cartridge capable of providing 5X to 10X for today's memory capacity. This cartridge should be designed to operate in harsh military environments and provide features such as safe memory management, high speed network connectivity and long term reliable operations. The read/write access is of prime importance. The memory must support both 32 and 64 bit addressing schemes, high burst and sustained read/write capabilities and meet real time secure erasable requirements plus offer error detection/bad memory block management features. Memory access must be compatible with existing avionics networks such as MIL-STD-1553 versions, FibreChannel and/or Ethernet and provide a fast PCI interface connection to a cartridge loader. In order to transition this product to the weapon systems, close coordination will be required between all parties involved.

PHASE I: Demonstrate proof-of-concept of proposed solution to meet the requirements above.

PHASE II: Build and test a single prototype memory cartridge to provide performance measurement to ensure safe operation in a rugged environment.

PHASE III: Using the Phase II design, implement a bulk Mass Storage Cartridge for flight qualified parts.

PRIVATE SECTOR COMMERCIAL POTENTIAL/DUAL-USE APPLICATIONS: These products could be made available for mobile applications such as next generation automobiles, aircraft and distributed Homeland Defense Systems.

REFERENCES:
1. Innovative Press release Silicon launches new Z-RAM technology that doubles embedded DRAM density for SoCs Makes SOI lower cost than bulk silicon; Standard SOI logic process with no extra steps; Lausanne, Switzerland, Jan 24, 2005
http://www.innovativesilicon.com/en/news_240105.php;
2. MoSys Announces Quad-Density Memory Technology; 1T-SRAM-Q Technology Enables New Levels of On-Chip Memory (http://www.us.design-reuse.com/news/news4521.html).
3. Intel Stacked Memory Packaging - http://www.intel.com/design/flcomp/prodbref/298051.htm
4. Press release Document no: PR20011003 Kingmax 1GB PC133 Registered DIMM with Highest Density Solution - http://www.kingmax.com/news/news_product/doc/20011003.doc

KEYWORDS: Avionics; Networks; Network Centric Warfare; Bulk Memory Storage; R&R Memory Cartridges; Solid State Memory

N05-142 TITLE: W Band, Real Time Wireless Network for Avionics Applications

TECHNOLOGY AREAS: Air Platform, Information Systems

ACQUISITION PROGRAM: F/A-18E/F

The technology within this topic is restricted under the International Traffic in Arms Regulation (ITAR), which controls the export and import of defense-related material and services. Offerors must disclose any proposed use of foreign nationals, their country of origin, and what tasks each would accomplish in the statement of work in accordance with section 3.5.b.(7) of the solicitation.

OBJECTIVE: Develop innovative technologies that leverage commercial real-time applications to up-convert frequency to W Band for extreme short-range applications.

DESCRIPTION: Many of tomorrow's platforms will need to increase their infrastructure to accommodate emerging Network Centric Warfare capabilities. The rapid growth of wireless technology is ever increasing and capable of connecting multiple computers under constraints of commercial implementations. These constraints tend to reflect an emphasis on bandwidth but not timeliness. The DOD is interested in implementing a real-time wireless architecture that will be backward compatible with existing wired networks such as FibreChannel, MIL-STD-1553 versions and Ethernet. A complete mathematical foundation is required for end-to-end operation that provides predictable, stable performance. The performance characteristics of the whole network must be guaranteed and stable within the constraints of temporal accuracy, stability and high utilization. Graceful degradation is required and must be based on a mathematical foundation that emphasizes testability and predictability. The use of 60GHz frequency (W-band) is desired using low power level to interconnect boxes/weapons within close proximity. The network must provide adaptive power levels monitoring and tailoring to optimize signal level to a minimum and must meet the needed bit error rate (BER) or 10-12. The network must also provide an executive layer to provide such attributes as adaptive routing; passive monitoring sleep modes; support both burst and continuous transmissions; adaptive filtering to overcome multi-path issues and provide adequate addressing to host a minimum of 100 active nodes.

PHASE I: Evaluate and analyze Network Centric requirements, identify technology challenges and identify hardware/software solutions to overcome such challenges. Develop an initial network design to support a minimum of 4 nodes. The design should address the quality of service (QoS), BER and throughput objectives and be designed to operate in a harsh military environment including the survivability concerns when operating wireless networks near armed weapons.

PHASE II: Build and test this network in an integration lab. The network must be able to measure key parameters to ensure compliance with design goals outlined in Phase I.

PHASE III: Design and build flight worthy hardware for test and evaluation.

PRIVATE SECTOR COMMERCIAL POTENTIAL/DUAL-USE APPLICATIONS: This technology could be applicable to numerous Homeland secure applications including the future network capable automotive markets.

REFERENCES:

1. 1996 IEEE Paper on W-band InGaAs/InP PIN Diode Monolithic Integrated Switches by Solid State Electronics Laboratory, Department of Electrical Engineering and Computer Science, The University of Michigan
2. http://www-1.ibm.com/services/us/imc/pdf/gt510-3968-giga-bits-per-second.pdf
3. http://www.eweek.com/article2/0,3959,826049,00.asp
4. http://networks.siemens.de/solutionprovider/_online_lexikon/indxw.htm
5. http://www.intel.com/netcomms/technologies/wimax/

KEYWORDS: Avionics; Wireless Networks; W Band Antennas; Network Centric Warfare; FibreChannel; Ethernet

N05-143 TITLE: Backplane Internet Protocol Connectivity in Linux

TECHNOLOGY AREAS: Air Platform, Information Systems

The technology within this topic is restricted under the International Traffic in Arms Regulation (ITAR), which controls the export and import of defense-related material and services. Offerors must disclose any proposed use of foreign nationals, their country of origin, and what tasks each would accomplish in the statement of work in accordance with section 3.5.b.(7) of the solicitation.

OBJECTIVE: Develop kernel level software modules targeting the 2.6.2*n versions of Linux, which will enable internet protocol (IP) based communication across the compact peripheral component interconnect (cPCI) backplane, and the versa module eurocard (VME) backplane (separate modules).

DESCRIPTION: Industrial computing environments often use several processor cards across one backplane. Rather than exchanging data over the Ethernet chipsets common to these boards, even faster connectivity may be available by communicating across that backplane. Since the addressing of the backplane is not possible in "user space", where applications normally run, this software would need to run at the kernel level, where the programmer can directly address the underlying hardware, and likely the existing IP stack. The desired implementation would support user datagram protocol (UDP), as a minimum, and transmission control protocol (TCP), if possible, rather than conjoining TCP and IP.

With the recent release and growing acceptance of the 2.6 family of kernels in soft real time applications, and with the growing popularity of open source solutions in the tactical software community, Linux is a valuable environment for backplane connectivity.

The proposer should be familiar with VME and CompactPCI backplanes, as well as development of kernel level modules (drivers) for Linux 2.6 release kernels. Design, develop, test and fix kernel level modules to support IP over the backplane for cPCI and VME, using separate, or the same, Linux drivers for the 2.6 kernel.

PHASE I: Demonstrate feasibility and determine capability of proposed module to meet the stated requirements. Determine a method to test and maintain the module as the Linux kernels evolve.

PHASE II: Develop and demonstrate an executing prototype for one backplane. Solicit feedback from probable users and develop a revised executing prototype, to include an application programming interface, and associated development artifacts such as unified modeling language (UML) diagrams, and basic instructions for use. Modify and demonstrate the kernel for the second type of backplane (cPCI or VME), updating the development artifacts and source codes.

PHASE III: The kernel level modules will be used as our mission computer expands to multiple processor cards on a single backplane, and as other mission computers which currently have multiple processors, migrate to Linux.

PRIVATE SECTOR COMMERCIAL POTENTIAL/DUAL-USE APPLICATIONS: Similar capabilities are available in proprietary real-time operating systems and contribute to their continuing popularity. This is likely to be widely embraced by real-time, embedded, and industrial software developers, and in turn, generate opportunities to sell training, books, etc. on the subject kernel API, at a minimum. Depending on how well the module is isolated from other GNU software, the vendor may be able to commercially license their extension in much the same way that Red Hat licenses its Linux products.

REFERENCES:

1. Usenet group on the Linux kernel, visible on the web at this URL or on NNTP at NEWS:
2. Various Gnu and Linux.org web pages, such as http://gnu.kookel.org/LDP/HOWTO/Module-HOWTO/.
3. Various VME standards: http://www.vita.com/pubslist.html
4. Various PCI and Compact PCI standards: http://www.picmg.com/specifications.stm.
5. Linux Device Drivers by Alessandro Rubini and Jonathan Corbet: http://www.xml.com/ldd/chapter/book/

KEYWORDS: Linux; Linux kernel; Linux Kernel Level Module; cPCI; CompactPCI; VME

N05-144 TITLE: <u>Sealant Application Process and Technology Development</u>

TECHNOLOGY AREAS: Materials/Processes

ACQUISITION PROGRAM: F-35/Joint Strike Fighter

The technology within this topic is restricted under the International Traffic in Arms Regulation (ITAR), which controls the export and import of defense-related material and services. Offerors must disclose any proposed use of foreign nationals, their country of origin, and what tasks each would accomplish in the statement of work in accordance with section 3.5.b.(7) of the solicitation.

OBJECTIVE: Develop method of applying Class B or C highly viscous sealants while satisfying time and quality requirements.

DESCRIPTION: Current methods of sealant application are time consuming and applicator dependent, resulting in unwanted variation in quality. It is important to the current aircraft weight requirement needs to obtain a uniform bead of sealant of the correct thickness that is also free of porosity and gaps in fuel areas. Often these areas are in confined spaces, making manual application difficult. Sealant needs to be uniformly spread over all areas of the faying surface in a minimum amount sufficient to provide a continuous bead of sealant "squeeze out" along all flange edges after the parts are assembled. Quality and other criteria are defined as in MIL-S-83430. A possible solution could be the spraying of sealant.

PHASE I: Identify and define a viable approach for applying Class B or C sealants that will meet quality criteria relating to thickness, porosity, and application time.

PHASE II: Develop, demonstrate, and validate the process for application of Class B sealant by developing a process and/or prototype that meets the needs.

PHASE III: Continue refinement of process and develop commercialized version.

PRIVATE SECTOR COMMERCIAL POTENTIAL/DUAL-USE APPLICATIONS: This process could be used in the automotive and boating industries for the quick application of sealants. It also has potential for the spray of insulation for various applications.

REFERENCES:
1. “PRC and Pro-Seal Aerospace Sealants Glossary.” PRC Aerospace Sealants, February 1999.
2. “Adhesives Go Automated – Boosting Speed, Accuracy,” Manufacturing Engineering Magazine. July 1985.
3. “Adhesive and Sealant Dispensing Concepts and Approaches.” Technical Paper #TP99PUB180, Society of Manufacturing Engineers. January 1999.
4. MIL-S-83430. Military Specificaiton. SEALING COMPOUND, INTEGRAL FUEL TANKS AND FUEL CELL CAVITIES, INTERMITTENT USE TO 360 DEG. F

KEYWORDS: Sealant; Viscous; Faying Surface; Porosity; Manufacturing

N05-145 TITLE: Core Milling Processes and Technologies

TECHNOLOGY AREAS: Materials/Processes

ACQUISITION PROGRAM: F-35/Joint Strike Fighter

The technology within this topic is restricted under the International Traffic in Arms Regulation (ITAR), which controls the export and import of defense-related material and services. Offerors must disclose any proposed use of foreign nationals, their country of origin, and what tasks each would accomplish in the statement of work in accordance with section 3.5.b.(7) of the solicitation.

OBJECTIVE: Develop a new innovate method of cutting/shaping loaded core materials without delamination or adversely affecting the material properties, while using high speed and precision technology.

DESCRIPTION: The current method of cutting loaded core materials utilizes an ultrasonic knife attached to a five axis-milling machine. This process is very slow, requires extensive Numerical Control programming, and rapidly dulls a series of uniquely shaped cutters (knives) to slice the material into shape. Multiple passes are required to achieve the final configuration of the materials.

PHASE I: Demonstrate proposed processes and equipment for cutting/shaping the loaded core material. The new processes and equipment should reduce cycle time by a minimum of fifty percent over the current process and address new more efficient methods for setup and part preparation. This is particularly important as the current fabrication requirements routinely dictate order quantities of one.

PHASE II: Conduct process optimization and evaluate scale-up issues associated with new process. Perform design of experiments or related process to document the new process capabilities and insure a profile of .010 is achieved. A minimum CpK of 1.33 is required.

PHASE III: Demonstrate "production ready" process to include fabrication of full-scale demonstration articles and testing to validate the process.

PRIVATE SECTOR COMMERCIAL POTENTIAL/DUAL-USE APPLICATIONS: Loaded core material is typically only used in military aircraft, however, conventional unloaded core is used throughout the civilian aircraft industry. Equipment and processes developed to shape and trim these materials would be widely transferable to industry.

REFERENCES:
1. "Robotic Manufacture of Honeycomb Core Details," Technical Paper#TP85PUB453, Society of Manufacturing Engineers. January 1985.

KEYWORDS: Core material; Five Axis Machining; Cutting Tools; Numberical Control Programming; Statistical Process Control; Manufacturing

N05-146 TITLE: Limited Access Drilling

TECHNOLOGY AREAS: Materials/Processes

ACQUISITION PROGRAM: F-35/Joint Strike Fighter

The technology within this topic is restricted under the International Traffic in Arms Regulation (ITAR), which controls the export and import of defense-related material and services. Offerors must disclose any proposed use of foreign nationals, their country of origin, and what tasks each would accomplish in the statement of work in accordance with section 3.5.b.(7) of the solicitation.

OBJECTIVE: Develop a flexible, ergonomic, high speed, burr-less (if possible), and safe system for drilling precision limited access holes specifically for the F-35 internal mating process. Currently development efforts include the use of a right angle power-feed drill, driven by an air-over-oil system. The controlled thrust force limits tool breakage, heat build up, and composite delamination; however, the air and oil cavity sizes required to generate the required thrust exceed the maximum space allowable.

DESCRIPTION: F-35 complex structural and assembly design requires precision hole drilling in areas with limited human access, specifically during the mating of the forward fuselage assembly, center fuselage assembly, wing assembly, and aft assembly. Current drilling methods, limited to small, handheld, right-angle power-feed drill motors and manual, non-power-feed drill motors (used in the tightest spots), compromise operator safety and hole quality. Therefore, the technical risk resides in the ability to produce quality holes minimizing or eliminating scrap, rework, or repair, while meeting cost and schedule requirements.

Hole sizes included in these limited access areas are 0.191", 0.251", 0.312" and 0.374". Engineering hole tolerances include a diameter requirement of +0.003" / -0.000" and a positional accuracy of +/-0.002" through material stacks of aluminum/aluminum, composite/aluminum, composite/titanium, composite/composite, and aluminum/composite/titanium. Required minimum stroke length is 1.25". Due to the composite portions of the material stacks, drilling thrust forces should be limited to no greater than 120 pounds in order to prevent delaminations.

Limited access constraints require that the radial distance from the drill bit center point to the top outermost portion of the device be no greater than 0.75”. Space between bulkheads or other structural components gets as small as 6”. Additionally, span time as well as cost per hole should be competitive with conventional drilling processes.

Efforts are currently underway to develop a right angle power-feed drill, driven by an air-over-oil system. The controlled thrust force limits tool breakage, heat build up, and composite delamination; however, the air and oil cavity sizes required to generate the required thrust exceed the maximum space allowable.

PHASE I: Develop a conceptual design for a viable drilling system that meets performance requirements described above. Develop a cost-effective approach for construction and testing. Provide a simulation of the designed system utilizing provided F-35 models. Fabricate and demonstrate functionality of critical design components.

PHASE II: Build and test a prototype to demonstrate the system’s abilities to meet requirements as well as overcome access constraints.

PHASE III: Finalize the design and construction for a commercialized system.

PRIVATE SECTOR COMMERCIAL POTENTIAL/DUAL-USE APPLICATIONS: This technology could be used to drill holes in limited access areas for commercial aircraft, the automotive industry, and maritime systems.

REFERENCES:
1. Washington, W. L. (1976). “Drilling of Composite and Aluminum Materials.” Retrieved April 10, 2005, from Aerospace & High Technology Database.
2. Gilley III, C. A., & Seago, R. A. (1996). Peck drilling of composite/metal assemblies. AEROFAST '96; Bellevue, Washington; USA; 1-3 oct. 1996; AEROFAST '96, Bellevue, Washington; USA, 73-118.
3. Zhao, J., Li, Z., & Fan, R. (2004). ”Study of Drilling Force for Carbon-epoxy Composite.”
4. Ponticel, P. (2003). “Drilling, Installation of Fasteners Leaned Out at Boeing.” Aerospace Engineering, 23(9), 26-27.

KEYWORDS: Composite Drilling; Aluminum Drilling; Titanium Drilling; Right Angle Motors; Manufacturing

N05-147 TITLE: Acquisition Decision Expert Planning Technology for Modernization (ADEPT-M)

TECHNOLOGY AREAS: Information Systems, Materials/Processes, Weapons

OBJECTIVE: Develop a collaborative web-based, expert decision support technology solution that will result in a capability to allow Participating Acquisition Resource Managers (PARM) to efficiently plan, coordinate, model and track all aspects of ship modernization. The new capability must be use an "expert reasoning" type technology solution that provides adaptive and interactive resource management, budgeting, cost control, risk identification and mitigation, conflict alerts, efficiency analysis and configuration management that will facilitate efficient modernization decision-making at several levels of management. The capability must support both new construction and back-fit efforts and be expandable to accommodate all types of maritime systems (Combat Systems, HM&E, C4I, Joint and commercial systems). The development of innovative web-based expert/decision support system algorithms to support this effort are necessary to ensure that multiple large legacy (existing) web-based data sources can be manipulated to allow real-time decision support via modeling and simulation, multi-layered analysis and prioritization, collaborative scheduling and deconfliction, highly tailorable reports, and automated coordination both within and across PARMs and Ship Platform Manager (SPM) organizations.

DESCRIPTION: PARMs are responsible for acquiring and developing systems to modernize Naval vessels. As such, PARMs must coordinate each system modernization effort very closely with Ship Platform Managers (SPM), other PARMs, contractors, In-Service Engineering Agents (ISEAs), planning yards, equipment manufacturers and laboratories in order to assure effective ship integration and system interoperability. This modernization planning process is extremely complicated and tedious due to the number of interdependencies between budgets, organizations, processes, schedules and systems. This is even further complicated by the fact that the majority of the modernization planning process requires manual interaction with several large web-based data sources that do not have automated decision support capability. Additionally, it is not currently feasible to conduct automated modeling of cost, schedule or performance metrics prior to execution. Although some automated tools exist to consolidate Navy modernization database sources, they do not exist at the PARM level nor do they include expert decision support systems. Overall, modernization planning is expensive and inefficient because it is labor intensive, redundant, vulnerable to inaccuracies and planning gaps, and is largely reactive. The urgency for this capability has increased due to recent directives that have changed the Fleet Response Plan (FRP) and maintenance processes requiring tighter timelines yet increased responsiveness.

PHASE I: Define the technology requirements for the capability and prepare a system design and software build plan. The design and build plan will identify the legacy data analysis algorithm sets necessary to provide the web-based “expert” system useful data to analyze and develop real-time tailored reports, models, decision aids and coordinated schedules and will address events, activities and inter-relationships required for a typical modernization effort. The contractor(s) will demonstrate that the capability development plan will support producing a collaborative decision support expert system capability to allow PARMs to efficiently plan, coordinate, model and track all aspects of ship modernization. This will be accomplished via the development of a conceptual rapid prototype shell computer demonstration. This rapid prototype shell will be supported with a descriptive "White” Paper along with a POA&M.

PHASE II: Develop the conceptual rapid prototype shell into a pre production capability. Then test and demonstrate the web-based expert decision support system algorithms and automated planning tools by performing modeling and simulation of modernization events in order to validate the capability. Specifically demonstrate:
* That the automated capability provides adaptive resource management, budgeting, cost control, risk identification and mitigation, alerts, efficiency analysis, configuration management and decision-making.
* Integration/interoperability with existing modernization databases and the ability to provide real-time tailored reports, modeling results, multi-layered analysis and prioritization, decision aids and collaborative scheduling within and across PARM organizations.
* That the capability supports both new construction and back-fit efforts and is expandable to accommodate all types of maritime systems (Combat Systems, HM&E, C4I, Joint and commercial systems).
* That the tool set can be utilized to maintain real time configuration management information for existing systems.
* How the capability can be used to provide cost savings.
* Security and accessibility features.

PHASE III: Based on the success of the Phase II prototype, expand the anlaysis and decision support modules into a fully operational capability with real time connectivity with all required legacy data sources. Field the capability across U.S. Navy, and Joint acquisition programs to standardize modernization and installation planning

PRIVATE SECTOR COMMERCIAL POTENTIAL/DUAL-USE APPLICATIONS: Innovative decision support tools could easily be applied to private shipbuilding or modernization efforts (cruise ships, cargo, tankers) and is adaptable to commercial construction planning efforts. Additionally, the planning algorithms could be extended to accommodate other functions beyond modernization such as system engineering, testing, acquisition milestone planning, etc (eg; ADEPT-S, ADEPT-T, etc).

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Web-based reference (several useful links and areas of interest):
http://www.aaai.org/aitopics/html/mining/html

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46. OPNAVINST 4720.2 Fleet Modernization Policy
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48. CLF/CPFINST 4720.3 Management of Afloat Combat Systems and C4I Installations
49. COMNAVSURFOR 4720.3 Joint Fleet Maintenance Manual

KEYWORDS: algorithm; collaborative; decision; expert; modernization; planning

N05-148 TITLE: Hybrid Sailor performance and training

TECHNOLOGY AREAS: Human Systems

ACQUISITION PROGRAM: LCS

OBJECTIVE: Define the required aptitude measures and test(s), as well as, recruiting guidelines for hybrid sailors on an optimally manned ship.

DESCRIPTION: Surface ships now being developed represent a new warfighter-system paradigm. Substantial manning reduction goals will need to be met. For the new surface combatants operating in the new environment of Defense of the Homeland operations, flexibility will be key. The sailors serving this new fleet will be required to cross-train for a wider variety of functional assignments. New ship concepts for rapid mission reconfiguration capability will further complicate the sailors environment. Team building and team effectiveness will be critical. Identifying individuals most likely to complete training and mature into experienced competent sailors will be critical. As the scope and cost of training increases there is a growing need to assure that recruitment targets individuals with the needed range of personal abilities and attributes.

The required aptitude for a hybrid sailor for future ship platforms has yet to be quantified, therefore, it is desired that an assessment methodology be developed to guide recruitment and training on an individualized basis. Stress level management and measurement must be included in any aptitude measurement. In the envisioned multi-tasking roles for hybrid sailors of the future, stress management will be as vitally important as circuit diagram comprehension or fluid dynamics.

PHASE I: The awardee shall perform task analysis which will validate task apportionment for one type of proposed hybrid sailors of future combatants. The awardee will identify the research methodology that will be employed; identifying applicable existing findings and identify gaps in the current state of knowledge as applies to the implementation of a hybrid sailor within the current rating structure. After documenting these Task analysis and apportionment, the awardee will document the findings with respect to the navy’s current rating structure. This research will guide the follow on creation and documentation of a set of aptitude standards and an aptitude test that will be used for identifying a hybrid sailor. In turn, the research will also guide the creation of business rules for recruiting future sailors. The awardee shall also develop a plan to validate the aptitude standards, aptitude testing procedure and the recruiting business rules.

PHASE II: The awardee shall develop the aptitude test as described above into a full prototype for this one type of hybrid sailor recruit. The awardee shall develop an aptitude predictor score methodology for one type of hybrid sailor. The awardee shall generate business rules for recruiting future sailors into this specific type of hybrid sailor rating. All products shall be validated via laboratory controlled statistically valid field tests and documented in a final report with expanded guidance and plans for expanding this capability across all other future hybrid sailor requirements..

PHASE III: The awardee shall develop an aptitude measurement process for all types of hybrid sailors, verify the applicability of the aptitude test for all types of hybrid sailors and validate all results. Finally, tracking methods must be developed and implemented to measure the overall effectiveness of these new screening processes in the fleet.

PRIVATE SECTOR COMMERCIAL POTENTIAL/DUAL-USE APPLICATIONS: There are multiple applications of this product; the medical industry will benefit from the application of stress measurement capability, the education industry will benefit from the new classification and measurement ability from the application of aptitude measurement and apportionment.

The education industry has many standardized tests that test students in the traditional areas of education, such as mathematics, vocabulary, and composition. These individual measurements can infer a student's capablity to perform in an academic environment. The link between multiple areas that indicates capability for job performance is lacking. Since job performance does not have clearly defined topical boundaries, a measurement and apportionment ability is required.

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KEYWORDS: manning; optimal manning; aptitude; task; multitasking; testing; stress; stress management

N05-149 TITLE: <u>Combat Systems of the Future</u>

TECHNOLOGY AREAS: Ground/Sea Vehicles, Sensors, Electronics, Battlespace

OBJECTIVE: Incorporate artificial intelligence (AI) to provide the Operator solutions in order to reduce manning.

DESCRIPTION: The process of decision-making in the Ocean Battlespace Environment (e.g., littorals) has become more complex and time-consuming for the operator using multiple sensors and electronics due to increased contact densities encountered and the decreased timeline for which decisions must be enacted within a very smaller margin of error. Therefore the evaluation of data sets used to process a decision and the employment of artificial intelligence (AI) within that process must be explored and algorithms developed based on structural and human behavioral models, heuristic inference rule sets as well as numerical algorithms. Design problem / risk is in software development, knowledge engineering and user interface development. The evaluation of data sets used to process a decision and the employment of artificial intelligence (AI) within that process must be explored and incorporated within the surface and subsurface Tactical and Operational decision process.

PHASE I: Develop and document methods and data set definitions, required inputs and outputs (e.g., acoustic sensors, off-hull sensors, radar sensors, ESM, Intel on-hull/off-hull, off-board data, visual, electro-optical sensors, imagery, weapons, navigation, communications) to support innovative research of artificial intelligence (AI) and/or Correlation and Fusion Engine(s) to determine processing requirements for AI to receive and distribute multi-sensor data to multiple interfaces. Pending this analysis, produce AI feasibility study.

PHASE II: Develop and integrate electronic and sensor data into an AI and/or Correlation and Fusion Engine prototype and perform initial stand-alone and integrated laboratory testing with baseline systems and proposed systems upgrades in support of Submarine Modernization efforts. Demonstrate effectiveness and efficiency of the engine in a laboratory Beta site.

PHASE III: The data sets and methods developed under Phase I and tested under Phase II will be sufficiently commercialized that they can be applied to a wide set of products and will be transitioned into the Advanced Processor Build (APB) testing process for open architecture (OA) and Sea based systems on-board Surface and Submarine vessels.

PRIVATE SECTOR COMMERCIAL POTENTIAL/DUAL-USE APPLICATIONS: This system could be applied to any environment that involves complex decision-making human interface, such as commercial transportation, patient monitoring and nuclear power plant monitoring.

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KEYWORDS: Decision; analysis; automated; human; artificial; intelligence

N05-150 TITLE: <u>Automated Generation of Maintenance Work Packages</u>

TECHNOLOGY AREAS: Information Systems, Materials/Processes, Weapons

ACQUISITION PROGRAM: DD(X)

The technology within this topic is restricted under the International Traffic in Arms Regulation (ITAR), which controls the export and import of defense-related material and services. Offerors must disclose any proposed use of foreign nationals, their country of origin, and what tasks each would accomplish in the statement of work in accordance with section 3.5.b.(7) of the solicitation.

OBJECTIVE: Develop an approach to automatically generate fault or failure specific maintenance work packages based upon data received by current and future shipboard equipment health management systems.

DESCRIPTION: Maintenance related activities represent a substantial portion of the Total Ownership Costs of any system. A significant portion of the total maintenance expenditure can be attributed to both direct and indirect (hidden) costs associated with maintenance planning activities. Direct costs include the identification of a maintenance condition, manual retrieval of technical data, maintenance procedure development, and revision of existing, cataloged, maintenance procedures due to a configuration change. Indirect costs due to inadequate planning include safety errors resulting in personnel injury or pollution, rework, material expediting, and resource conflict resolution. Automation can play a key role in reducing these costs by minimizing the time currently spent by sailors in the identification of a maintenance action(s), correlating and presenting information necessary to perform a maintenance action(s) and by ensuring that all necessary resources e.g. tools, parts, etc. are available to the sailor.
The maintenance cycle includes three main functions which must be integrated in order to successfully automate a maintenance activity. Those functions are:
1. Equipment Health Management
2. Work Package Generation
3. Maintenance Execution Planning

Proposed concepts should address technical data format and storage requirements as well as package delivery to a maintenance technician so that the topic objectives can be met without human intervention. Sources/types of technical data include Vendor/Design Configuration data and Interactive Electronic Technical Manuals (IETMs) data that currently reside in storage devices onboard ship ashore. Open architecture standards shall be employed in all concepts proposed.

The Navy will provide access to representative Vendor/Design Configuration data and Interactive Electronic Technical Manuals as needed.

PHASE I: Demonstrate the feasibility of an automated maintenance work package generation approach which would be electronically delivered to a maintenance tech without human intervention upon identification of a condition-based maintenance need by an automated equipment health monitoring system. Establish performance goals and metrics to analyze the feasibility of the proposed solution. Provide a Phase II development approach and schedule that contains discrete milestones for product development.

PHASE II: Finalize the design and fabricate a prototype system based on Phase I results. Through laboratory testing and characterization experiments, demonstrate the viability of the systems capability to meet the performance goals established during Phase I. Provide a detailed plan for software certification, validation, and method of implementation onboard future surface combatant systems.

PHASE III: Utilizing the concept developed during Phase I and II, work with Navy and industry to certify and implement this technology to existing and future surface combatant systems and commercial utility and manufacturing sectors.

PRIVATE SECTOR COMMERCIAL POTENTIAL/DUAL-USE APPLICATIONS: This technology would have application in Commercial Shipping, Utilities, or manufacturing industry maintenance management organizations.

REFERENCES:
1. Joint Fleet Maintenance Manual – Rev A Change 1; COMFLTFORCOM 4790.3 http://www.submepp.navy.mil/Jfmm/index.htm
2. Naval Sea System Command Inst 4790.8B, Ship's Maintenance Management and Material (3-M) Manual; http://www.spear.navy.mil/NAVSEA/NAVSEAINST_4790_8B.pdf
3. Commander Naval Surface Forces Maintenance Notice 4702 Surface Ship Work Package Prep. http://musrv.spear.navy.mil/maintu/ShipMain.htm#ShipMainInstructions
4. Commander Naval Surface Forces Maintenance Notice 4703 Surface Ship Maintenance Placement and Oversight Business Rules. http://musrv.spear.navy.mil/maintu/ShipMain.htm#ShipMainInstructions
5. MILITARY PERSONNEL Navy Actions Needed to Optimize Ship Crew Size and Reduce Total Operating Costs, Government Accounting Office Report GAO-03-520 http://www.gao.gov/new.items/d03520.pdf
6. Applicable Navy Requirements Available Upon Request

KEYWORDS: maintenance; planning; shore-based; shipboard; resource; repair

N05-151 TITLE: Shock and Vibration Mounting System for Machinery and Electronics

TECHNOLOGY AREAS: Ground/Sea Vehicles, Materials/Processes

ACQUISITION PROGRAM: DD(X)

The technology within this topic is restricted under the International Traffic in Arms Regulation (ITAR), which controls the export and import of defense-related material and services. Offerors must disclose any proposed use of foreign nationals, their country of origin, and what tasks each would accomplish in the statement of work in accordance with section 3.5.b.(7) of the solicitation.

OBJECTIVE: Develop an innovative, low cost system(s), which has varying static properties and provides dynamic shock and vibration mitigation over a wide operating load range for machinery and electronics onboard surface combatant vessels.

DESCRIPTION: Isolation mounts are used extensively on naval ships to 1) protect equipment from the effects of shock, 2) reduce vibration noise from the hull to sensitive acoustic interrogation systems and 3) to minimize the transmission of vibration energy of machinery and electronics to the ship hull. Future naval vessels operating in littorals and ASW environments are subject to more stringent vibration requirements than have been employed in the past. The ability of future surface ships systems to withstand shock and mitigate vibration is critical for ensuring safe operations. Existing solutions impose unfavorable weight, cost, and space penalties and do not adequately address both the necessary shock and vibration mitigation within the same isolation system.

The Navy recognizes that one solution may not fill all potential applications; however, simplicity and commonality of solutions will be favorably weighted. Extra consideration will be given to proposals that provide static and dynamic load mitigation to a broad range of marine equipment and load configurations. Concepts should target loads ranging from .5 lbs to 10,000 lbs.

Where applicable, the solution(s) proposed shall identify alternate materials and/or techniques for mounting system design and subsequent demonstration of their performance.

PHASE I: Demonstrate the feasibility of an innovative approach to shock and vibration mitigation for machinery and electronic systems onboard surface combatant vessels. Establish performance goals and metrics to analyze the feasibility of the proposed solution. Develop a Test and Evaluation Plan that contains discrete milestones for product development for verifying performance and suitability.

PHASE II: Finalize the system design(s), fabricate and characterize the static and dynamic properties of the proposed Phase I concept(s). Fabricate associated hardware and conduct laboratory testing to demonstrate shock and vibration mitigation performance. Document the test results and their confirmation of the proposed system design(s). Provide a plan for developing a production-scalable process to build and install the mounting system(s) and for obtaining Navy certification for shipboard installation. Evaluate the processes for ease of installation and the associated cost and weight benefits of new design and concepts compared to current Navy shipboard practices.

PHASE III: Utilizing the concept developed during Phase I and II, work with Navy and industry to certify and implement this technology to existing and future surface combatant systems and commercial utility and manufacturing sectors.

PRIVATE SECTOR COMMERCIAL POTENTIAL/DUAL-USE APPLICATIONS: Lightweight isolation systems could have commercial value in aircraft, manufacturing facilities, or cruise ships where vibration abatement is required for machinery and electronics equipment.

REFERENCES:

1. Naval Sea System Command, DDS180-1 Design Data Sheet: Foundation Design for Navy Surface Ships, 31 Dec 1983.
2. Naval Sea System Command, DDS073-2 Design Data Sheet: Structureborne Noise Control, Oct 1980.
3. SNAME T&R Bulletin 3-37, Design Guide for Shipboard Airborne Noise Control
4. Supplement to the Design Guide for Shipboard Airborne Noise Control: www.SNAME.org
5. Loeser, Harrison, Fundamentals of Ship Acoustics: Acoustical Phenomena In and Around Ship, 1999. (www.SNAME.org)
6. USCG NVIC 12-82 Recommendations On Control of Excessive Noise : NVIC 12-82
7. OSHA: Occupational noise exposure. - 1910.95
8. Applicable Military Requirements Available Upon Request.

KEYWORDS: Mount; shock isolation; mounting system; vibration mitigation; foundation

N05-152 TITLE: Autonomous Movement of Containers from Ship to Shore

TECHNOLOGY AREAS: Ground/Sea Vehicles

ACQUISITION PROGRAM: T-AKE

OBJECTIVE: Development of an approach and the technologies necessary to autonomously move standardized ISO Containers from ship to shore.

DESCRIPTION: This topic seeks innovative scientific and engineering solutions to address the development of the capability to autonomously move universally standard ISO cargo containers from a ship environment to the shore, for example by incorporating the ISO container as a structural element of a modular autonomous sea vehicle. This topic offers an opportunity to infuse new ideas/innovations into the military and commercial shipping industries. Proposed concepts can be either organically employed upon modification to the container and/or require ship/pier-side assistance for implementation/ removal. Proposed concepts should address methods of self deployment or other innovative approaches to accomplish the same objective, and shall be capable of autonomously navigating to shore, either a beach or pier. Concepts should address means of unloading or transferring the cargo upon destination arrival. The ISO container must be able to return back to its original configuration/un-deployed state for the purposes of stowage and possible movement via other method of transportation i.e. truck, rail, etc. Proposed concepts must require minimal manpower and time to execute. The anticipated technical challenge is in the command, control, communication, propulsion and navigation aspects of "transforming" an ISO container into an autonomous, self-deploying vehicle.

PHASE I: Demonstrate the feasibility of the proposed approach(es). Perform modeling and simulation as needed as a means of demonstrating feasibility. Provide a preliminary concept design and validation plan.

PHASE II: Design, develop, and fabricate the approach(es) proposed in Phase I. In a laboratory or scale model environment, demonstrate the capabilities of the proposed concept(s) as means of validation. Document the test results and their impact on the proposed approach(es).

PHASE III: Working with the Navy and/or Industry as applicable, fabricate and conduct at-sea testing of a pre-production prototype as required.

PRIVATE SECTOR COMMERCIAL POTENTIAL/DUAL-USE APPLICATIONS: ISO Containers are used universally throughout the commercial industry. The technology being developed will provide the commercial shipping industry an innovative and non-manpower intensive means of autonomously moving containers in and out of shallow water ports especially in third world countries with undeveloped port infrastructures. The technology would be of particular interest to humanitarian organizations and shore based emergency response teams for hurricane, flood, etc.

REFERENCES:
1. Marine Corps Concept Paper Seabased Logistics – A 21st1 Century Warfighting Concept (Forward…from the Sea, and Operational Maneuver from the Sea chart the direction for Naval Forces of 21st Century)
2. Seabased Logistics: Distribution Problems for Future Global Contingencies Proceedings of the 1997 Winter Simulation Conference
3. An analysis of STOM (Ship To Objective Maneuver) in Sea Based Logistics Proceedings of the 2002 Winter Simulation Conference
4. http://www.export911.com/e911/ship/dimen.htm

KEYWORDS: Autonomous; container; Sea Basing; littoral; cargo; landing craft

N05-153 TITLE: Ruggedized, Reconfigurable, Watercraft Stowage System

TECHNOLOGY AREAS: Ground/Sea Vehicles, Materials/Processes

ACQUISITION PROGRAM: LCS

The technology within this topic is restricted under the International Traffic in Arms Regulation (ITAR), which controls the export and import of defense-related material and services. Offerors must disclose any proposed use of foreign nationals, their country of origin, and what tasks each would accomplish in the statement of work in accordance with section 3.5.b.(7) of the solicitation.

OBJECTIVE: The development and demonstration of a reconfigurable, watercraft stowage device for small deck ships.

DESCRIPTION: The next generation of Navy combatants will utilize modular mission packages to provide focused mission capability, facilitate technology refresh, and maximize warfighter capability in the battlespace environment. Representative examples of mission modules include (but is not limited to) offboard watercraft (e.g., 11m Rigid Hull Inflatable Boat (RHIB), Remote Mine hunting Vehicle (RMV), Swimmer Delivery Vehicle (SDV), and 40-foot High Speed Boat which can be up to 12 metric tons in weight. The ability to stow and maintain watercraft is critical to the implementation of modular mission packages. Presently, each type of watercraft is provided with a custom cradle for stowage and transport that does not individually meet naval requirements for shock and vibration. The Navy envisions that in the future, the operation and change-out of multiple types of offboard watercraft will be required aboard surface ships which may translate to the launching of one type of vehicle and recovering of a different type.

This topic seeks innovative approaches to the development of a ruggedized, reconfigurable stowage device applicable to multiple types of watercraft. The system proposed must have a low acquisition and life cycle costs, be mechanically simple, and provide for safe stowage for a variety of watercraft in a variety of shipboard conditions including high speed and sea states. The system must minimally impact the various watercraft so as to preserve mission performance and promote use with multiple and varied watercraft. The system must be capable of long-lived operation in a harsh marine environment including the requirements for shock and vibration and must be usable on multiple naval platforms. The system must present minimal impacts to the ship, especially as related to external watercraft launching positions, which generally represent highly desirable locations with multiple functions.

PHASE I: Demonstrate the feasibility of a reconfigurable, watercraft stowage system. Provide a prototype design including drawings, projected capabilities, weight and cost projections. Develop key component technological milestones.

PHASE II: Fabricate and demonstrate a prototype of the system developed in Phase I. Through land-based testing, demonstrate the ability of the system to reconfigure to stow multiple types of watercraft in a variety of simulated shipboard conditions. Conduct lifecycle testing and provide cost estimates (both acquisition and lifecycle).

PHASE III: Conduct shipboard testing to evaluate performance and develop plan to implement the reconfigurable, watercraft stowage device onboard LCS Flight 1 or other Naval platforms.

PRIVATE SECTOR COMMERCIAL POTENTIAL/DUAL-USE APPLICATIONS: A reconfigurable, watercraft stowage device would have direct use on commercial or research vessels where operating, transporting and stowing multiple types of watercraft are a concern. A stowage device that is adaptable to multiple types of watercraft will potentially increase deck space and allow for flexibility in stowage configurations.

REFERENCES:
1. “Capability Development Document For Littoral Combat Ship,” December 2004.
2. “Interface Control Document (ICD) for Littoral Combat Ship (LCS) Flight Zero Reconfigurable Mission Systems,” Baseline 1.0, 18 February 2005.

KEYWORDS: Cradle; Stowage; Transport; Watercraft; Off-board Vehicle; Reconfigurable

N05-154 TITLE: <u>Process Control and Manufacturing Technologies to Promote Shipbuilding Affordability</u>

TECHNOLOGY AREAS: Materials/Processes

ACQUISITION PROGRAM: DD(X)

The technology within this topic is restricted under the International Traffic in Arms Regulation (ITAR), which controls the export and import of defense-related material and services. Offerors must disclose any proposed use of foreign nationals, their country of origin, and what tasks each would accomplish in the statement of work in accordance with section 3.5.b.(7) of the solicitation.

OBJECTIVE: The objective of the project is to develop and implement innovative materials processing and manufacturing technology research that will reduce the cost and cycle time to construct, modernize and repair Navy ships.

DESCRIPTION: The Navy's Program Executive Office for Ships is leveraging the National Shipbuilding Research Program (NSRP) to effect change across the non-nuclear surface shipbuilding, modernization and repair enterprise by coordinating with U.S. shipbuilders to adapt and implement "World Class" commercial best practices in the area of "Process Control" and "Manufacturing Technologies". The US shipbuilding industry lags behind the global shipbuilding market significantly in these areas and the introduction of new technology is key to closing this gap.

This topic seeks innovative scientific and engineering solutions to inefficiencies in long-standing industrial process control and manufacturing technology areas. This topic offers an opportunity to infuse new ideas/innovations into the domestic shipbuilding industry. Of particular interest are initiatives with a clear business case. Proposals should specifically describe the technology that will be applied to solve the problem, how it will be developed, what the estimated benefits will be and how it might be transitioned into the shipbuilding industry. While NSRP members are available to provide guidance, assistance in the preparation of proposals and in the execution of efforts awarded from this solicitation, team or consulting with the shipbuilding and repair industry (both public and private yards) is not required and will not be a factor in proposal selection.

Proposals under this topic must address at least one of the research areas identified. Efforts cited within each research area are illustrative only and proposals dealing with other efforts within each research area are also solicited.

1. Process Control: Develop, pilot, and provide innovative process control methodologies or programs that can improve standardized production processes and accuracy control techniques, as well as cost, schedule and quality management methodologies into ship design, shipbuilding, ship modernization, repair or disposal. Research areas include:
- Component and Assembly Distortion Control
- Statistical Process Control

2. Manufacturing Technologies: Innovative, functionally-based manufacturing technology capabilities are required to support U.S. shipbuilding and repair operations. Develop, pilot, and provide manufacturing technologies, processes and/or material improvements that would result in measurable labor, cycle time and/or material savings. Research areas include:
- Joining Technologies and Implementation of Robotic systems
- Material Cutting and Processing Technologies
- Technologies for Cost-Effective Facility Modernization

PHASE I: Demonstrate feasibility for improvements being developed and also identify impact upon shipbuilding affordability. Include a first-order Return-On-Investment (ROI) analysis for industry implementation and estimate potential Total Ownership Cost (TOC) reduction. Establish Phase II performance goals and key developmental milestones.

PHASE II: Finalize the design, as appropriate, and demonstrate a working prototype of the system. Perform laboratory tests to validate the performance characteristics established in Phase I. Develop a detailed plan and method of implementation into a full-scale application.

PHASE III: Implement the Phase III plan developed in Phase II in coordination with the shipbuilding and repair industry.

PRIVATE SECTOR COMMERCIAL POTENTIAL/DUAL-USE APPLICATIONS: The technology developed under this topic shall be directly applicable to current military and commercial shipbuilding repair operations and practices. The products develop should find wide use in most heavy industrial plant/processing facilities such as in the power industry and repair practices and marketable to the shipbuilding and repair industry.

REFERENCES:
1. NSRP ASE Strategic Investment Plan, available on line at http://www.nsrp.org/
2. List of Past and Current NSRP Research Projects, available on line at http://www.nsrp.org/
3. Shipbuilding Technology and Education, National Academies Press, Washington DC, 1996

KEYWORDS: shipbuilding; affordability; production; manufacturing; processes; maintainability

N05-155 TITLE: Durable, Low Radar Signature Return, Flight Deck Coating System

TECHNOLOGY AREAS: Air Platform, Ground/Sea Vehicles, Materials/Processes

ACQUISITION PROGRAM: DD(X)

The technology within this topic is restricted under the International Traffic in Arms Regulation (ITAR), which controls the export and import of defense-related material and services. Offerors must disclose any proposed use of foreign nationals, their country of origin, and what tasks each would accomplish in the statement of work in accordance with section 3.5.b.(7) of the solicitation.

OBJECTIVE: Develop and demonstrate a high-friction, durable coating system that provides a low radar signature return for flight decks and is suitable for use in a marine environment.

DESCRIPTION: Currently available deck coating systems that could be utilized in applications where fluctuating operating temperatures and heavy traffic/heavy load areas are the norm (such as the flight deck of a surface combatant) have poor to negligible performance in the areas of reduced radar signature return. This topic seeks the development of a coating system that can withstand the traffic and wear that a flight deck would witness during the course of daily operations. The system proposed must address reduced radar cross-section as well as being durable, maintainable, logistically supportable, and must prevent corrosion of the deck structure itself. The solution(s) proposed must be able to be applied by industrial activities and meet environmental protection and applicable health and safety restrictions, e.g. volatile organic content (VOC), toxicity, etc. The solution(s) must be repairable while the ship is in service. The solutions(s) should not be projected to add excessive weight to the ship.

PHASE I: Demonstrate the feasibility of a high friction, durable, coating system that provides low radar signature return and is suitable for use on flight decks in a marine environment. Establish approach, validation goals and metrics to analyze the feasibility of the proposed solution. Provide a Phase II development approach and schedule that contains discrete milestones for product development.

PHASE II: Finalize the design approach and develop a prototype or prototypes based on the results in Phase I. In a laboratory environment, use representative systems to demonstrate the viability of the prototype product. Develop testing procedures to measure the effectiveness of the product and develop a plan for a potential ship-board validation. Provide a detailed plan for NAVAIR and NAVSEA certification and validation, as applicable.

PHASE III: Use the concept developed during Phase I and II, work with Navy and industry to conduct validation testing and NAVAIR/NAVSEA certification for use on a Navy ship. Use the results of this testing to tailor the product to the needs of the DD(X) Program Office in concert with the DD(X) Prime Contractor.

PRIVATE SECTOR COMMERCIAL POTENTIAL/DUAL-USE APPLICATIONS: This technology would be directly applicable to the communications industry to provide an improved coating system to minimize interference due to the signal reflection of radio or magnetic waves. Communication tower platforms also require the same protection and are the staging points for the removal/addition of large pieces of equipment.

REFERENCES:

1. MIL-PRF-24667A(NAVY) COATING SYSTEM, NON-SKID (applicable only regarding the stated coefficient of friction requirements)

KEYWORDS: coatings; RCS; flight deck; durability; radar

N05-156 TITLE: Maintenance Performance Assessment

TECHNOLOGY AREAS: Information Systems, Materials/Processes, Weapons

ACQUISITION PROGRAM: DD(X)

The technology within this topic is restricted under the International Traffic in Arms Regulation (ITAR), which controls the export and import of defense-related material and services. Offerors must disclose any proposed use of foreign nationals, their country of origin, and what tasks each would accomplish in the statement of work in accordance with section 3.5.b.(7) of the solicitation.

OBJECTIVE: Develop a maintenance performance, information collection and analysis approach that will obtain pertinent performance data during the conduct of individual maintenance actions, validate the performed procedures or processes, and identify the cause of any deviation(s) or delay(s).

DESCRIPTION: In order to meet reduced manning and cost goals, existing and future Navy ships are utilizing sensors and other automated technologies to monitor equipment health and provide accurate information to end users. Onboard future surface ships, it is envisioned that maintenance planning will be automated and maintenance procedures will be delivered to the technician in an electronic format on interactive media. This interaction represents opportunities to monitor technician responses and behaviors and collect technician input to determine the effectiveness of procedures and the accuracy of information provided for conducting repairs.

The central thrust of this topic is to develop an approach to collect, for individual maintenance actions, pertinent performance data to identify causes of delay and process deviation in order to update and improve maintenance and related logistics processes.

The following types of functionality are germane to achieving the system performance desired:
- Information collection during maintenance action execution with little or no human interaction
- Establish control limits to trigger an analysis
- Determine reason for delay and/or deviation such as
- Improper procedures
- Incorrect technical data
- Incorrect parts, configuration data
- Training deficiencies
- Improper duration estimate
- Provide a method of feedback to allow for review and possible correction
- Identify design and supportability issues requiring a potential in-service engineering resolution

PHASE I: Demonstrate the feasibility of a data collection and analysis approach that will provide the ability to collect pertinent performance data, for individual maintenance actions, to identify causes of delay and process deviation in order to update and improve maintenance and related logistics processes. Establish performance goals and metrics to analyze the feasibility of the proposed solution. Provide a Phase II development approach and schedule that contains discrete milestones for product development.

PHASE II: Finalize the design and fabricate a prototype system based the design concept(s) proposed in Phase I. Through laboratory testing and characterization experiments, demonstrate the viability of the system's ability to identify causes of delay and process deviation and provide feedback to the system user. Provide a detailed plan for software certification, validation, and method of implementation into a future ship support environment.

PHASE III: Utilizing the concept prototype developed during Phase I and II, work with Navy and industry to certify and implement this technology to existing and future surface combatant systems.

PRIVATE SECTOR COMMERCIAL POTENTIAL/DUAL-USE APPLICATIONS: This technology would have direct application in commercial industry to improve maintenance and related logistics support processes to enhance production-planning accuracy.

REFERENCES:
1. Joint Fleet Maintenance Manual – Rev A Change 1; COMFLTFORCOM 4790.3
http://www.submepp.navy.mil/Jfmm/index.htm
2. Naval Sea System Command Inst 4790.8B, Ship's Maintenance Management and Material (3-M) Manual; http://www.spear.navy.mil/NAVSEA/NAVSEAINST_4790_8B.pdf
3. Condition Based Maintenance (CBM) Policy; OPNAVINST 4790.16
http://www.acq.osd.mil/log/logistics_materiel_readiness/organizations/mppr/html/condition_based.htm
4. Condition Based Maintenance Plus Policy Memorandum; 25 Nov 2002. See link provided in 3.above.
5. Military Personnel Navy Actions Needed to Optimize Ship Crew Size and Reduce Total Operating Costs, Government Accounting Office Report GAO-03-520 http://www.gao.gov/new.items/d03520.pdf
6. Applicable Military Requirements available upon request.

KEYWORDS: maintenance; performance; logistics; availability; planning; mission readiness

N05-157 TITLE: Dynamic Positioning and Motion Control during Cargo Transfer Operations

TECHNOLOGY AREAS: Ground/Sea Vehicles, Materials/Processes, Weapons

ACQUISITION PROGRAM: T-AKE

The technology within this topic is restricted under the International Traffic in Arms Regulation (ITAR), which controls the export and import of defense-related material and services. Offerors must disclose any proposed use of foreign nationals, their country of origin, and what tasks each would accomplish in the statement of work in accordance with section 3.5.b.(7) of the solicitation.

OBJECTIVE: Develop an innovative, portable, dynamic positioning and motion control system to enable the transfer of cargo via crane from a supply ship to a landing craft without the use of mooring lines or fenders.

DESCRIPTION: This topic seeks the development of a portable dynamic positioning and motion control system that will enable the transfer of cargo from a supply ship to a landing craft (such as an LCU 1600 landing craft) without the use of mooring lines or fenders. The system developed shall minimize the pitch, yaw and roll moments of the landing craft vessel when transferring cargo in a Sea State 3 environment. The system shall be capable of interfacing with the steering system of the landing craft but should provide manual approval and override to the landing craft operator. The system proposed shall not require a permanent change to the landing craft as the landing craft must be able to return back to its original configuration/un-deployed state for the purposes of stowage. The system should be able to be configured with minimal manpower and time to execute. Installation of a portable system cannot reduce the payload capacity of the landing craft.

PHASE I: Demonstrate the feasibility of a portable, dynamic positioning and motion control system. Perform modeling and simulation as needed as a means of demonstrating feasibility. Document these efforts and provide a preliminary concept design and Phase II validation plan.

PHASE II: Design, develop and fabricate the approach proposed in Phase I. In a laboratory environment, demonstrate the capabilities of the proposed concept as a means of validation. Document these efforts and develop a Phase III at-sea implementation plan.

PHASE III: Working with the Navy, demonstrate the transfer of cargo from a supply ship to an LCU 1600 equipped with the Dynamic Positioning and Motion Control System at sea 25 nm from shore. The supply ship will be equipped with cranes similar to those in T-ACS Class ships having active pendulation control. Develop specifications for incorporation into future transport craft such as landing craft and lighterage.

PRIVATE SECTOR COMMERCIAL POTENTIAL/DUAL-USE APPLICATIONS: The technology being developed under this topic for positioning of vessels would be applicable to commercial vessels where close position keeping relative to another vessel during cargo transfer is required. Examples of commercial applications include offshore supply vessels, lighterage, and ferries.

REFERENCES:
1. "Offshore Supply Vessel Positioning" by Mathewson, 1999
2. "Dynamic Positioning System for a Crane Barge " by Gragen, 1998
3. "New Techniques in Relative RTK GPS Positioning Between Dynamic Platforms" by Meagher, 2001
4. Janes Fighting Ships
5. LCU 1600 Class Vessel Drawings Available Upon Request
6. http://www.fas.org/man/dod-101/sys/ship/lcu.htm

KEYWORDS: Cargo Transfer; Dynamic Positioning Systems; landing craft; T-ACS; LCU; supply

N05-158 TITLE: Fuel Cell Energy Recovery

TECHNOLOGY AREAS: Ground/Sea Vehicles

ACQUISITION PROGRAM: DD(X)

OBJECTIVE: Develop a system, scalable to high kW levels, to convert the available energy from a fuel cell system into a usable form including electricity or water recovery to improve overall efficiency.

DESCRIPTION: Fuel cells operating on naval logistic diesel fuel (NATO F-76) offer a viable means to provide distributed ship service power, and electrical power for unmanned air and undersea vehicles. However, fuel processors are still much too complex to provide compact and lightweight systems needed in military applications. To reduce this complexity and improve overall durability of the fuel cell stack, new hydrogen separation membrane technology is being utilized in the present designs. As a result, energy recovery of the membrane raffinate is required while still maintaining membrane pressure in order to achieve high overall system efficiency. This SBIR topic covers energy recovery systems in the area of high power dense bottoming cycles and/or water recovery components which can utilize a fuel cell membrane raffinate stream composed of the following for a 500 kWe scale:

Inlet press: 7atm
Inlet temp: 400 C
Mole Fraction: .065 H_2, .41 H_2O, .019 CO, .20 CO_2, .016 CH_4, .29 N_2, Potential for trace amt H_2S (up to 50ppm)
Kg/hr: 900

PHASE I: Demonstrate the feasibility of a proposed solution to utilize the fuel cell system membrane raffinate stream for energy recovery and conversion. Emphasis will be placed on system conversion efficiency and power density. Further emphasis will be placed on the ability of the system to maintain upstream membrane pressure during lower flow conditions of up to 25% total flow below 900kg/hr for a 500 kWe scale system.

PHASE II: Develop a prototype 50 kWe fuel cell energy recovery and conversion system and perform laboratory tests to validate and demonstrate the system's ability. Based upon the prototype, develop a conceptual design (including cost estimates) of a thermal management method that is compatible with a fuel reforming stream for current fuel cell technologies aat the 500 kWe power level.

PHASE III: Transition the technology to commercial and military fuel cell applications.

PRIVATE SECTOR COMMERCIAL POTENTIAL: The system will be applied to a variety of commercial fuel cell technologies currently being applied to civilian applications and being evaluated for use in marine applications. This technology also has potential to be utilized by the Rail and Truck industries as well as many portable standby emergency power modules.

REFERENCES:

1. Donald Hoffman, “U.S. Navy Shipboard Fuel Cell Program” www.nsrp.org/st2003/presentations/hoffman.pdf, January 2003.
2. Power & Energy Inc., " Power+Energy Presents Data On High Efficiency Hydrogen Separation Membranes For Fuel Cells, http://www.purehydrogen.com/site_2002/news_documents/press_release_04_26_2005.html, April 2005.
3. Idaho National Engineering and Environmental Laboratory, “Reforming Diesel Fuel to Hydrogen”, March 2004, www.inel.gov/ env-techengineering/diesel_reformer_fs.rev3.3-22-04.pdf

KEYWORDS: Energy, fuel cell, hydrogen, heat, power, reformer, fuel

N05-159 TITLE: Wireless Pressure Sensors With Built-In Calibration Capability

TECHNOLOGY AREAS: Information Systems, Sensors

ACQUISITION PROGRAM: DD(X)

The technology within this topic is restricted under the International Traffic in Arms Regulation (ITAR), which controls the export and import of defense-related material and services. Offerors must disclose any proposed use of foreign nationals, their country of origin, and what tasks each would accomplish in the statement of work in accordance with section 3.5.b.(7) of the solicitation.

OBJECTIVE: Develop an approach and the technology to develop an innovative, ruggedized, wireless pressure sensor with built-in calibration capability.

DESCRIPTION: Presently, the Navy assures the accuracy of existing non-embedded shipboard sensors using several individuals who utilize manual procedures and a suite of electronic and mechanical calibration standards. Due to the number of existing sensors and the manpower required, calibration is only periodically but infrequently performed. The Navy is beginning to move toward a condition-based calibration philosophy, which focuses on conducting real-time calibration on an as needed basis with minimal impact on ship’s personnel.

The Navy seeks the development of a wireless, ruggedized pressure sensor with a built-in calibration capability that can be embedded into the equipment (such as a pressure gage) that it is monitoring thus precluding the transitional means of calibration/diagnosing. Key developmental areas will be 1) the ability of the sensor to assess and report its own health 2) the ability to self-calibrate as required or as directed and 3) methods of powering for a truly wireless, long-life sensor. The concept proposed should be based on open architecture protocols where practicable.

PHASE I: Demonstrate the feasibility of a wireless, ruggedized pressure sensor with built-in calibration capability. Conduct bench scale and/or simulation testing as appropriate as a means of feasibility demonstration. Provide a prototype design and develop key component technological milestones.

PHASE II: Design, develop and fabricate a prototype of the device proposed in Phase I. In a laboratory environment, demonstrate the capabilities of the prototype via laboratory characterization experiments as a means of validation. Using the results of the characterization experiments, refine the prototype. Provide a plan as to how this sensor will adhere to DoD directive 8100.2.

PHASE III: Working with the Navy and commercial industry, develop a packaged, commercial family of wireless pressure sensors with built-in calibration capability covering the full pneumatics and fluids types and ranges required. Demonstrate capability by installing such sensor into legacy pressure gage applications on a test ship such as the SDTS (ex-USS Foster) and automatically feed the sensors data into Integrated Condition Assessment Systems (ICAS).

PRIVATE SECTOR COMMERCIAL POTENTIAL/DUAL-USE APPLICATIONS: Any industry that uses large sensor networks would be greatly interested in reducing the cost of maintaining these networks which would be a direct result of a built-in calibration capability. Process control and paper pulping are just two of the businesses that would benefit greatly by this technology. Similar condition based calibration and built-in calibration technologies could be useful in diagnosis and maintenance of future deployed homeland security chemical and biological networked multi-sensor detection systems.

REFERENCES:
1. R. Rupnow; “New Calibration Strategies to Support Reduced Crew Sizes”, presented at 2005 Measurement Science Conference, January 2005.
2. R. Rupnow, J. Walden, X. Yun, D. Greaves, H. Glick; “New Calibration Standards for Next Generation Ship’s Monitoring Systems”, Thirteenth International Ship Control Systems Symposium (SCSS), April 2003
3. DoD directive 8100.2 dated 4/14/2004, SUBJECT: Use of Commercial Wireless Devices, Services, and Technologies in the Department of Defense (DoD) Global Information Grid (GIG)

KEYWORDS: calibration; sensor; wireless; embedded; pressure sensor; diagnostic;

N05-160 TITLE: Automation of Equipment/System Isolation and Safety Tag-out for Maintenance Actions

TECHNOLOGY AREAS: Information Systems, Materials/Processes, Weapons

ACQUISITION PROGRAM: DD(X)

The technology within this topic is restricted under the International Traffic in Arms Regulation (ITAR), which controls the export and import of defense-related material and services. Offerors must disclose any proposed use of foreign nationals, their country of origin, and what tasks each would accomplish in the statement of work in accordance with section 3.5.b.(7) of the solicitation.

OBJECTIVE: Develop and demonstrate a means of automating the functions inherent in isolating and tagging out a system(s) or component(s) that require maintenance.

DESCRIPTION: In order to prevent physical injury to personnel, avoid component damage, and maintain ship functions, system and component isolation and safety tag-out is required prior to commencing a maintenance or repair action. Current isolation methods require technicians to utilize hardcopy system schematics to determine the appropriate components (valves, switches, etc.) to isolate a system. This method is prone to error particularly with respect to the interpretation of complex system diagrams (ie: Engineering Operational Sequencing System (EOSS) drawings, etc.) and poses a subsequent safety risk to personnel and to the ship. The procedure is also manpower and time intensive requiring a minimum of 3 personnel to complete a tag-out action.

A decision-support and automated isolation capability is needed to:
- Precisely determine a component's isolation configuration
- Physically effect isolation through remote control and sensing of valves, breakers, and other electro-mechanical interfaces
- Validate and display the status of the component or system and multiple control stations

PHASE I: Demonstrate the feasibility of an automated isolation and tag-out concept in compliance with applicable industry standards. Provide a description and conceptual design demonstrating the feasibility of the concept. Illustrate using a typical shipboard isolation and tag-out operation and compare with a current Navy EOSS procedure as a basis for estimating manpower reduction. Include a Phase II development approach and schedule.

PHASE II: Develop a prototype decision support and automated equipment isolation system. Demonstrate multiple isolation and tag-out scenarios simulating operational conditions for critical and non-critical ships systems to evaluate its capability. Provide manpower and cost saving and performance metrics. Prepare an implementation and test plan for installation on a Navy ship in Phase III.

PHASE III: Utilizing the concept developed during Phase I and II, work with Navy and industry to approve and certify the proposed concept for use in Navy applications and then transition this technology to existing and future surface combatant systems.

PRIVATE SECTOR COMMERCIAL POTENTIAL/DUAL-USE APPLICATIONS: This technology would have universal application in industries such as power generation plants, manufacturing, and commercial ships where equipment tag-out of maintenance operations is enforced.

REFERENCES:

1. Joint Fleet Maintenance Manual – Rev A Change 1; COMFLTFORCOM 4790.3
http://www.submepp.navy.mil/Jfmm/index.htm
2. Naval Sea System Command Inst 4790.8B, Ship's Maintenance Management and Material (3-M) Manual;
http://www.spear.navy.mil/NAVSEA/NAVSEAINST_4790_8B.pdf
3. Tag-out User's Manual; NAVSEA S0404-AD-URM-010/TUM
4. MILITARY PERSONNEL Navy Actions Needed to Optimize Ship Crew Size and Reduce Total Operating Costs, Government Accounting Office Report GAO-03-520 http://www.gao.gov/new.items/d03520.pdf

KEYWORDS: maintenance; safety; lock-out; tag-out; OSHA; automation

N05-161 TITLE: Improved Work Performance in a Shipbuilding Environment

TECHNOLOGY AREAS: Materials/Processes, Human Systems

ACQUISITION PROGRAM: DD(X)

The technology within this topic is restricted under the International Traffic in Arms Regulation (ITAR), which controls the export and import of defense-related material and services. Offerors must disclose any proposed use of foreign nationals, their country of origin, and what tasks each would accomplish in the statement of work in accordance with section 3.5.b.(7) of the solicitation.

OBJECTIVE: Develop and implement innovative technologies that will improve work performance within the shipbuilding environment; thereby reducing the cost and cycle time to construct, modernize and repair Navy ships.

DESCRIPTION: The Navy's Program Executive Office for Ships is leveraging the National Shipbuilding Research Program (NSRP) to effect change, across the non-nuclear surface shipbuilding, modernization and repair enterprise, by coordinating with U.S. shipbuilders to adapt and implement "World Class" commercial best practices. This topic addresses the area of improving overall job performance in a shipbuilding work environment and increasing knowledge and skills proficiency by providing an advanced, distributed learning and knowledge capture system for a ship design, shipbuilding, ship modernization, repair or disposal environment.

The Shipbuilding Industry is continually faced with the challenge of effectively capturing knowledge and retaining the skills of an aging workforce. This topic seeks innovative approaches to mine, develop and address implementation of new solutions within an existing industrial environment. The anticipated risk is in the seamless adaptation and application within a shipbuilding community. The cost-effectiveness and competitiveness of the domestic shipbuilding industry is relying on a successful solution(s).

Of particular interest are initiatives with a clear business case. Proposals should specifically describe the technology that will be applied to solve the problem, how it will be developed, what the estimated benefits will be and how it might be transitioned into the shipbuilding industry. While NSRP members are available to provide guidance and assistance in the preparation of proposals and in the execution of efforts awarded from this solicitation, team or consulting with the shipbuilding and repair industry (both public and private yards) is not required and will not be a factor in proposal selection.

Efforts cited within each research area are illustrative only and proposals dealing with other efforts within each research area are also solicited. Research areas include:

- Methods and techniques to implement, accelerate, and validate learning to achieve proficiency in shipbuilding industry skill standards.
- Knowledge capture methodologies to address the loss as well as the transfer of knowledge and experience from an aging or retiring workforce.
- Approaches to improving physically demanding work conditions.

PHASE I: Demonstrate feasibility for improvements being developed and also identify impact upon shipbuilding affordability. Include a first-order Return-On-Investment (ROI) analysis for industry implementation and estimate potential Total Ownership Cost (TOC) reduction. Establish Phase II performance goals and key developmental milestones.

PHASE II: Finalize the design, as appropriate, and demonstrate a working prototype of the proposed system(s). Perform laboratory tests to validate the performance characteristics established in Phase I. Develop a detailed plan and method of implementation into a full-scale application.

PHASE III: Implement the Phase III plan developed in Phase II in coordination with the shipbuilding and repair industry.

PRIVATE SECTOR COMMERCIAL POTENTIAL/DUAL-USE APPLICATIONS: The technology developed under this topic shall be directly applicable to current military and commercial shipbuilding repair operations and practices. The products develop should find wide use in most heavy industrial plant/processing facilities such as in the power industry and repair practices and marketable to the shipbuilding and repair industry.

REFERENCES:
1. NSRP ASE Strategic Investment Plan, available on line at http://www.nsrp.org/
2. SP Panel Project Summary - Workforce Development for Shipbuilding, available on-line at http://www.nsrp.org/
3. Megan D. Sullivan, "Knowledge-Capturing Technologies and the Culture of Change", Ithaca College, Ithaca, NY 2004 available at http://www.iabc.com/fdtnweb/pdf/2004KnowledgeCapture.pdf

KEYWORDS: ship affordability; human systems; learning: skills retention; tutors;

N05-162 TITLE: Obsolescence Management Decision Making and Planning Tool

TECHNOLOGY AREAS: Information Systems, Ground/Sea Vehicles, Materials/Processes

ACQUISITION PROGRAM: DD(X)

The technology within this topic is restricted under the International Traffic in Arms Regulation (ITAR), which controls the export and import of defense-related material and services. Offerors must disclose any proposed use of foreign nationals, their country of origin, and what tasks each would accomplish in the statement of work in accordance with section 3.5.b.(7) of the solicitation.

OBJECTIVE: Demonstrate an approach that will provide a quantitative analysis capability for decision making and planning for the purposes of obsolescence management.

DESCRIPTION: The effect of part obsolescence on product design, construction, and supportability can be very costly from both a system performance and financial perspective. Design phases of programs can take place over the course of years, during which time specified hardware and software might be upgraded by manufacturers or even discontinued. Additional negative impacts are created by the loss of suppliers over time coupled with material shortages. Technology can also become obsolete due to changing mission requirements based on evolving threats. As a result, significant re-design costs can occur in order to ensure contractually agreed upon performance goals.

This topic seeks the development of an approach to quantitatively analyze an obsolescence problem in the framework of an entire ship configuration in order to obtain the most cost effective approach to address the obsolescence issue. The solution proposed must be able to accept platform configuration data and obsolescence related information down to lowest repairable unit (LRU) in order to determine the most cost effective obsolescence mitigation action. The solution shall have the capability of evaluating the costs associated with the proposed mitigation approach vs. maintenance/repair of the existing components; the replacement system mission reliability vs. current mission reliability, and identification of ship system impact(s) of the obsolescence mitigation alternatives proposed. The approach proposed should employ the use of open architecture principles as practicable.

PHASE I: Demonstrate the feasibility of an approach for obsolescence management. Establish validation goals and metrics to analyze the feasibility of the proposed solution. Provide a Phase II development approach and schedule that contains discrete milestones for product development.

PHASE II: Finalize the design approach and fabricate a prototype system based on the results in Phase I. In a laboratory environment, use representative inputs/data to demonstrate the viability of the prototype product. Develop testing procedures to measure the effectiveness of the tool and develop a plan for a potential ship-wide validation exercise. Provide a detailed plan for software certification and validation, as applicable.

PHASE III: Expanding the concept developed during Phase I and II, work with Navy and industry to conduct validation testing using real data for a Navy ship. Use the results of this testing to tailor the decision-support capability to the needs and input capabilities of the DD(X) Program Office in concert with the DD(X) National Design Team.

PRIVATE SECTOR COMMERCIAL POTENTIAL/DUAL-USE APPLICATIONS: The airline industry, delivery sector and any manufacture that has capital equipment with a greater life expectancy than discrete elements of the whole would be interested in this type of decision support tool.

REFERENCES:
1. Keeney, R.L. "Value-Focused Thinking: A Path to Creative Decision-Making" Harvard University Press, Cambridge, MA 1992
2. Military Modeling for Decision Making, 3rd Edition; Hughes, Wayne P.
3. "A Method and System for Decision Oriented Systems Engineering", United States Patent Application Publication, Pub No.: US-2003-0177047-A1, Sep 18, 2003.
4. "A Method and System for Decision Oriented Systems Engineering", International Publication No.: WO 2004/084061 Pub. Date: 30 September 2004.

KEYWORDS: Obsolescence; Management; planning; decision-making; refresh, logistics

N05-163 TITLE: Tools for Rapid Insertion or Adaptation of Combat System Capabilities

TECHNOLOGY AREAS: Information Systems, Sensors

OBJECTIVE: Design, develop, and demonstrate methodologies and tools that will enable rapid insertion of innovative and advanced C2 (command and control) and combat system technologies into the complex open-architecture framework of existing combat systems for naval tactical and surveillance operations.

DESCRIPTION: New and rapidly emerging threats may require innovative adaptation of new technologies by the combat systems architecture. Many new and advanced technologies as well as methodologies are being applied today to complex commercial systems to respond to needs that are both time critical and cost sensitive. Adapted appropriately, similar methodologies and approaches would have equal potential to significantly reduce the time and cost of inserting new and innovative capabilities into military combat systems. Such methodologies must apply to the existing combat systems architecture and be applicable to the Global Information Grid (GIG)/Net-Centric Enterprise Services (NCES) service-oriented architecture framework. These systems can be very complex, so a new technical capability may not be readily adaptable to such systems configuration. Tools and methodologies developed under this topic should enable new C2 and combat system technologies to be rapidly inserted, adapted and deployed to the warfighter.

The topic seeks creative and innovative approaches to the problem. However, in an effort to further guide potential performers, we offer the following example focus areas: innovative design of interfaces for easy adaptation of dissimilar component configurations while ensuring technical and communication compatibility within the system, proxy servers or wrappers that allow legacy systems/sensors to work with new capabilities, tools to model and simulate the effect of new capabilities on the system, etc.

PHASE I: Design and demonstrate the tools or methodologies that will facilitate the rapid insertion of advanced combat system technologies into tactical or surveillance systems. Develop validation criteria and approaches, as well as milestones, for Phase II.

PHASE II: Implement the tools and methodologies from Phase I in a prototype and demonstrate the technology for the rapid insertion of an advanced combat system capability into a selected naval tactical or surveillance open architecture system.

PHASE III: Assist the Navy and prime contractors in the implementation of successful approaches in ongoing program developments.

PRIVATE SECTOR COMMERCIAL POTENTIAL: Refinements of technologies or process methodologies made as a result of being adapted for use in military systems can be applied to complex, high reliability, commercial platforms.

REFERENCES:

1. Net-Centric Services: http://www.disa.mil/
2. Open Architecture: http://www.opengroup.org/rtforum/oa_rtes/
3. FORCEnet: http://www.chinfo.navy.mil/navpalib/cno/proceedings.html
4. Ken Bergman, 'Using topographic engineering to achieve dominance in urban and complex terrain,' http://www.wood.army.mil/ENGRMAG/PDFs%20for%20Jan-Mar%2005/Bergman.pdf
5. N.R. Jennings, T.J. Norman, P. Faratin, et al. "Autonomous agents for business process management". Applied Artificial Intelligence, 14(2): 145-189, 2000.

KEYWORDS: Technology Insertion, Open Architectures, Combat Systems, Legacy systems, Service-Oriented Architecture

N05-164 TITLE: Quick Chill

TECHNOLOGY AREAS: Materials/Processes, Human Systems

OBJECTIVE: Develop an energy efficient, rugged, shipboard capability to quickly chill a canned beverage product (e.g., soda pop, or "soft drink") to help eliminate the requirement for operating traditional vending machines at sea.

DESCRIPTION: For the primary customer on a ship (male, 22 years old), a key Quality of Life (QOL) element as documented by customer surveys is the ability to obtain a cold soft drink from a vending machine. That the per capita consumption of the commodity is almost double the U.S. per capita rate (52 gal a year) testifies to the popularity and desirability of this service. To satisfy this demand, the Navy as part of its QOL programs provides soft drink vending machines on ships. The design of the ship (storerooms separated from selling locations) coupled with the lack of transportation aids and the requirement to have up to 14 machines on larger ships has driven large platforms to devote up to six (6) man-years of effort to keep the machines filled. As the cost of manpower has increased, the need to find alternatives to provide this key QOL product has grown.

The desire is to develop a device capable of chilling a soft drink within 10 seconds, which is estimated to be the upper limit, or customer wait time tolerance, for the beverage consumer. The militarized version of the device needs to be compact and reliable, with little or no in-service maintenance requirements. Such a device, when distributed throughout the shipboard environment, could provide the following benefits:

• Eliminate, or minimize, shipboard requirements for environmentally threatening use of refrigerants (o-zone deleting substances)
• Potentially remove all labor requirements involved in the operation of vending machines.
• Removing the requirement for the product to be chilled at the point-of-sale, enabling more purchasing and storage flexibility to both the retailer (Ship's Store) and the consumer (sailor)

The rapid chilling of bulk food products (e.g., dairy, fruits & vegetables) and especially solid food (e.g., carcass meat, fresh fish) is a long sought-after industry endeavor that has posted modest advances, with futuristic sights on a capability akin to a "reverse microwave". Restricted by the same heat transfer principles, the objective to rapidly chill a packaged consumer beverage can proceed towards a similar outcome when, and if, technology pushes past the decades-old capability of the vending machine. Rapid chill, with chill-on-demand service, is an evolutionary step away from the trappings of 20th century vending technology.

Consumer appeal for a chill on demand capability is demonstrated in sales of counter-top, household products promising to chill a bottle of wine in six minutes, or a canned beverage in one minute. However, products currently known to be available are extremely limited in applicability, essentially relegated to home use given the need to add both water and ice to the device. Other chill-on-demand technologies include a self-refrigerating beverage can promising to cool 30o F in three minutes.

While these two examples of technological applications demonstrate the variability in potential approaches for obtaining the desired objective, neither is close to the required shipboard solution (ease-of-use, adequate chilling within 10 seconds). In addition, before any organization will embrace a modern technology, it will determine if the cost of new technology is “affordable” either in acquisition cost or “tradeoff” cost of providing the current service. The shipboard technical requirement exceeds any technology known to be available in the marketplace, and therefore presents unusually high technical risk. For these reasons, some leeway may be accommodated for the desired objective considering the proposed study approaches received.

PHASE I: Investigate alternative technologies/approaches to rapidly chill aluminum can packaged soft drinks/beverages. Evaluate and document alternatives and a developmental approach for one or more candidate devices.

PHASE II: Develop a prototype and demonstrate performance in either a controlled U.S. Navy shipboard environment, or in an environment simulating shipboard power sources and space constraints.

PHASE III: Develop a unit scaleable for follow-on commercialization accommodating large-scale distribution (public outlet), consumer (household) operation, or designed installation aboard naval vessels.

COMMERCIAL POTENTIAL: While limited products are available in the commercial market, a faster and more (energy) efficient design could result from the requirements demanded of a shipboard application.

Specifically, applications are anticipated for both the consumer (household) and commercial (public vending) markets due to the continued desire of the consumer for “fast on demand” products. Depending on the scalability and cost of the end product, commercial applications able to be used by small business may be achievable. In either instance, chill-on-demand has the potential to provide ease, energy savings, and novelty, beyond the commonplace air-cooled refrigeration means currently in use.

REFERENCES:
1. Naval Supply Systems Command (NAVSUP) Publication 487; Retail Operations Module I and II (NEXCOMINST 5230.8A) software ships.
2. OPNAVINST 5090.1B, Environmental and Natural Resources Manual; Chapter 6, Management of Ozone Depleting Substances.
3. “Vending Machines” – Utility Savings Initiative (USI) Fact Sheet; State Energy Office, N.C. Department of Administration and the U.S. Department of Energy: http://www.landofsky.org/wrp/Assessment.html
(Vending Machine Fact Sheet).

KEYWORDS: Quick Chilling, Rapid Refrigeration, Afloat Supply Department of the Future, Refrigerant-Free At-Sea Application, Environmentally Safe, Environmentally Friendly, Energy Conservation, Resale Technology, Retail Technology, Ship’s Store Technology, Soda Can Chiller, Beverage Chiller.